

Unilateral high division of the sciatic nerve: a case report

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Abstract

Introduction: The sciatic nerve is the largest nerve in the body. It passes through the inferior part of greater sciatic notch below piriformis muscle. It enters the back of the thigh at the lower border of the gluteus maximus and runs vertically downwards up to the superior angle of popliteal fossa where it terminates by dividing into tibial and common fibular nerves. However it may divide within the pelvis and as such its relationship with piriformis becomes variable. One such variations in the division of sciatic nerve was encountered during routine cadaveric dissection of first M.B.B.S students in the department of anatomy, Government Medical College, Aurangabad in an adult male cadaver where the sciatic nerve divided high up in pelvis with the common fibular component piercing piriformis and tibial component passing inferior to its lower border. Such anatomical variation of the sciatic nerve may contribute to the entrapment neuropathy called piriformis syndrome, failed sciatic nerve block in anaesthesia and nerve injury during intramuscular injections in gluteal region.

Keywords: Sciatic nerve, Piriformis syndrome, Anatomical variation.

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INTRODUCTION

The Sciatic nerve is the largest nerve of the body and carries contributions from anterior primary rami of L4 to S3. It leaves the pelvis through greater sciatic foramen inferior to piriformis muscle. It divides into Common fibular and Tibial nerves. It innervates all muscles in the posterior compartment of thigh, part of adductor magnus originating from ischium, all muscles in the leg and foot, skin on the lateral side of leg and lateral side of sole of foot. ¹ The Sciatic nerve is really two nerves, the tibial and common fibular nerves that are loosely bound together in the same connective tissue sheath. They

usually separate approximately halfway or more down in the thigh however there are many anatomical variation of the level of separation of these nerves. They may separate in the pelvis, gluteal region or further down. In these cases their relationship with piriformis muscle is important.² High division of SN is usually unilateral or bilateral, that leads to compression of nerve resulting in piriformis syndrome, incomplete block of SN during popliteal block anesthesia and have a clinical importance in the etiology and pathogenesis of sciatica etc. This compression on nerve causes paralysis or paresis of the respective muscles and adequate sensory disturbances. In that case one cannot flex the lower limb in the knee joint. External version and plantar flexion of the extremity are also affected.³

CASE REPORT

During routine cadaveric dissection of first M.B.B.S students in department of anatomy, Government Medical College, Aurangabad, a case of unilateral high division of sciatic nerve is found in an adult formalin fixed male cadaver on the right inferior extremity. A curved skin incision from spine of second sacral vertebra along the iliac crest till tubercle is taken. Another vertical incision

from second sacral spine till the natal cleft is taken which is further extended downward till the middle of the back of thigh. Subcutaneous fat is removed and gluteus maximus is identified. Gluteus maximus is cut midway between its origin and insertion and flaps are reflected to either side to explore structures under cover it. Piriformis muscle is identified and its margins are defined.

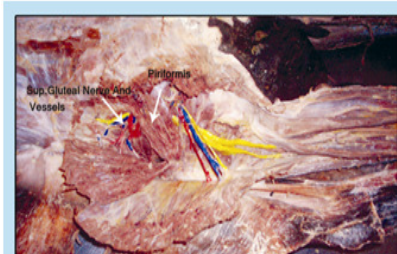


Figure 1: Showing structures under cover of gluteus maximus

In the present case the sciatic nerve divided in the pelvis and its tibial and common fibular components separated as they leave the pelvis. The tibial nerve was passing below piriformis muscle while common fibular nerve came out through pelvis by piercing piriformis. Both the nerves passed downwards between ischial tuberosity and greater trochanter along the back of thigh and remain separate throughout their course.

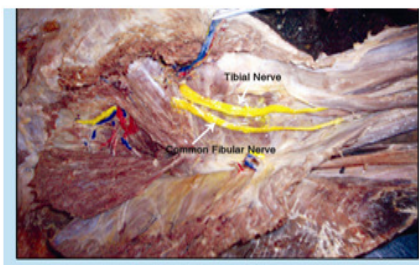


Figure 2: Showing common fibular nerve piercing piriformis while Tibial nerve passing below it

On the left inferior extremity there was no anatomical variation observed in relation with sciatic nerve. The sciatic nerve came out through pelvis inferior to lower border of piriformis. It descended downward along the back of thigh and terminated at the superior angle of popliteal fossa.

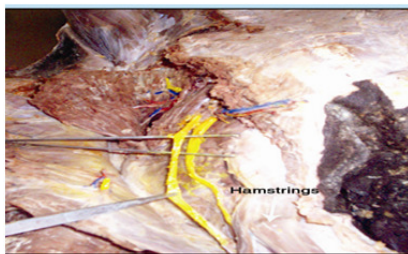


Figure 3: Showing high division of sciatic nerve Both nerves entering in the thigh

DISCUSSION

‘Perone’ is greek for fibula because of close relationship of nerve to fibular neck, its name has been changed internationally from common peroneal to common fibular nerve.¹ The sciatic nerve, 2 cm broad at its origin and broadest nerve in the body, is continuation of upper band of sacral plexus. It leaves the pelvis via greater sciatic foramen below piriformis and descends between greater trochanter and ischial tuberosity, along the back of thigh, dividing into the tibial and common peroneal (fibular) nerves proximal to knee, but can be pulled apart to their origins, when it can be demonstrated that the tibial is formed by union of ventral divisions of lumbosacral trunk and first three sacral rami, while the common peroneal is formed by dorsal division of lumbosacral trunk and first two sacral rami the sciatic nerve however divide anywhere, when division is at plexus the common peroneal nerve usually pierces piriformis muscle.⁴ The sciatic nerve is really two nerves, the tibial and common fibular nerves that are loosely bound together in the same connective tissue sheath. The tibial and common fibular nerves usually separate approximately half or more down in the thigh however in approximately 12% of cases they separate as they leave the pelvis. In these cases tibial nerve passes inferior to piriformis and common fibular nerve pierces the muscle or passes superior to it. In 12.2% of 640 limbs studied, sciatic nerve divided before it entered in gluteal region and common fibular nerve passed through piriformis. In 0.5% of cases common fibular nerve passed superior to muscle where it is vulnerable to injury during intragluteal injections.² There are variations in the course of sciatic nerve through gluteal region. Only approximately 85% of cases does it pursue its normal course. In 12% - 15% of instances, the nerve is divided by piriformis, the common fibular part comes through the muscle or above it and only tibial part passes below it. When two components of sciatic nerve are kept apart they may remain separate throughout their courses or they may unite below piriformis. In rare case (less than 1%) the entire sciatic nerve passes through piriformis.⁵ Many authors have attempted classification of high divisions of sciatic nerve, below there are six different types of higher divisions which was observed in previous studies of different researchers. Beaton and Anson^{1, 2} classified variations of the piriformis and SN in 120 specimens in 1937, and in 240 specimens in 1938. Their classification, known as the Beaton and Anson classification, is as follows:

Type 1: Undivided nerve below undivided muscle

Type 2: Divisions of nerve between and below undivided muscle

Type 3: Divisions above and below undivided muscle

Type 4: Undivided nerve between heads

Type 5: Divisions between and above heads
Type 6: Undivided nerve above undivided muscle

And for the above types different researchers got results as mentioned below.³

Table 1: Shows comparison between present study and previous studies

Name of Investigators	Specimen	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Beaton and Anson ⁶	120 cadavers	84.2%	11.7%	3.3%	0.8%		
Pecina ⁷	130		6.15%				
Beaton ⁸	240	90%	7.1%	2.1%	0.8%		
Chiba ⁹	14 extremities		34%				
UluotkuandKurtoglu ¹⁰	25 fetuses	74%	16%	10%			
Ugrenovic <i>et al</i> ¹¹	100 fetuses	96%	2.5%	1.5%			
MooreandDalley ²	650extremities		12.2%	0.5%			
Pokorny <i>et al</i> ¹²	91 cadavers	79.1%	14.3%	4.4%	2.2%		
Sayson <i>et al</i> ¹³	Single case						Single case
Patel <i>et al</i> ³	86 extremities	91.8%					
Present case	Single case		Single case				

J.A. Ogeng'o *et al* have exposed One hundred and sixty-four sciatic nerves from 82 cadavers of black Kenyans by dissection. In 33 (20.1%) cases division occurred in the pelvis, while in 131 (79.9%) it occurred outside the pelvis. A single trunk sciatic nerve exited below the piriformis muscle in 131 (79.9%) cases. In cases of pelvic division, the tibial nerve was always infrapiriformic, while the common peroneal nerve passed below piriformis in 16 (9.8%) cases, pierced the piriformis in 13 (7.9%), and passed above it in 4 (2.4%). For those in which division was extrapelvic, 110 (67.1%) were in the popliteal fossa, 17 (10.4%) in the middle third of the thigh, and 4 (2.4%) in the gluteal region. Where the division was pelvic, in 19 (11.6%) cases they continued separately, in 8 (4.9%) the two nerves reunited, and in 6 (3.7%) they were connected by a communicating nerve.¹⁴ H.A.M. Saleh, M.M.O. El-fark, G.A. and Abdel-Hamid have studied the level of division of the SN in the popliteal fossa and its relationship to the common epineural sheath of the SN. The level of division of the SN sheath into TN and CPN above the knee was measured in 30 cadaver specimens. The SN was invariably formed of independent trunks (TN and CPN) encompassed in one common epineural sheath. The SN divided at a distance range of 50 to 180 mm above the popliteal fossa crease. The findings suggest that the TN and CPN leave the common SN sheath at variable distances from the popliteal crease.¹⁵ The sciatic nerve is sometimes injured by penetrating wounds, fractures of pelvis or dislocations of hip joint. It is most frequently injured by badly placed intramuscular injections in the gluteal region. The common peroneal part is most affected because its nerve fibers are lie most superficial inn sciatic nerve. Sciatic nerve injury leadsto paralysis of hamstring muscles and all muscles below knee joint leading to ' foot drop'.¹⁶ A pain in the buttock mar result from compression of sciatic nerve by piriformis leading to entrapment neuropathy known as piriformis syndrome.

Persons involved in sports that require excessiveuse of gluteal muscles and women are more likely to develop this syndrome. (iceand roller skaters, cyclists and mountain climbers). In approximately 50% of cases, history indicates trauma to buttock associated with hypertrophy and spasm of piriformis.² Sciatic nerve can be blocked by injections of anaesthetic agent's superior to midpoint of line joining posterior superior iliac spine and superior border of greater trochanter.² Intramuscular injections into buttocks should always be made superior to line extending from posterior superior iliac spine and superior border of greater trochanter. Complications of improper technique include nerve injury, haematoma and abscess formation.²

CONCLUSION

High division of sciatic nerve is very important anatomical variation which should be kept in mind by surgeons as well as physician. This variation may lead to entrapment neuropathy of common fibular nerve resulting in piriformis syndrome, failed or incomplete anaesthetic block of sciatic nerve during popliteal block anesthesia and have a clinical importance in the etiology and pathogenesis of sciatica.

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